

WHAT IS CLAIMED IS:

1. An active anti-vibration apparatus comprising:
  - an anti-vibration table;
  - a movable portion mounted on said anti-vibration
  - 5 table;
  - a pneumatic spring for supporting and driving said anti-vibration table;
  - a servo valve for adjusting a pressure of said pneumatic spring;
  - 10 an electromagnetic actuator for applying a force to said anti-vibration table;
  - a displacement sensor for detecting displacement of said anti-vibration table;
  - an anti-vibration table displacement controller for
  - 15 generating a driving signal for said servo valve on the basis of an output from said displacement sensor so that said anti-vibration table keeps a predetermined posture at a predetermined position; and
  - an anti-vibration table vibration controller for
  - 20 generating a driving signal for said electromagnetic actuator,
  - wherein both said servo valve and said electromagnetic actuator are so controlled as to compensate for movement of a load that occurs when said movable portion
  - 25 moves on said anti-vibration table.
2. The apparatus according to claim 1, wherein said movable portion is a stage mounted on said anti-vibration

table, and

the apparatus further comprises

driving means for driving said stage,

a position sensor for detecting a position of said  
5 stage, and

a stage position controller for controlling the  
position of said stage on the basis of an output from said  
position sensor so as to coincide with a predetermined  
target position.

10 3. The apparatus according to claim 1, wherein said  
electromagnetic actuator applies to said anti-vibration  
table a force in at least one of the same direction as a  
support direction of said pneumatic spring and a direction  
perpendicular to said same direction.

15 4. The apparatus according to claim 1, further  
comprising an acceleration sensor for detecting an  
acceleration of said anti-vibration table,

wherein said anti-vibration table displacement  
controller generates the driving signal for said servo  
20 valve on the basis of an output from said displacement  
sensor and/or said acceleration sensor, so that said  
anti-vibration table keeps the predetermined posture at the  
predetermined position.

5. The apparatus according to claim 1, wherein at least  
25 one of a target position and a target speed of said movable  
portion is feed-forwarded to said anti-vibration table  
displacement controller and said anti-vibration table

vibration controller.

6. The apparatus according to claim 1, wherein a signal that filters at least one of a target position and a target speed of said movable portion is feed-forwarded to said  
5 anti-vibration table displacement controller and said anti-vibration table vibration controller.

7. The apparatus according to claim 6, wherein  
the filter includes first and second high-pass filters, and

10 a signal obtained by passing the target speed of said movable portion through the first high-pass filter and a signal obtained by passing the target position of the movable portion through the second high-pass filter are feed-forwarded to said anti-vibration table displacement  
15 controller and said anti-vibration table vibration controller, respectively.

8. The apparatus according to claim 6, wherein  
the filter includes low- and high-pass filters, and  
a signal obtained by passing the target speed of said  
20 movable portion through the low-pass filter and a signal obtained by passing the target position of the movable portion through the high-pass filter are feed-forwarded to said anti-vibration table displacement controller and said anti-vibration table vibration controller, respectively.

25 9. The apparatus according to claim 6, wherein  
the filter includes first and second low-pass filters, and

a signal obtained by passing the target speed of said movable portion through the first low-pass filter and a signal obtained by passing the target position of the movable portion through the second low-pass filter are  
5 feed-forwarded to said anti-vibration table displacement controller and said anti-vibration table vibration controller, respectively.

10. The apparatus according to claim 6, wherein the filter includes a low-pass filter, and

10 a signal obtained by passing the target speed of said movable portion through the low-pass filter is feed-forwarded to both said anti-vibration table displacement controller and said anti-vibration table vibration controller.

15 11. The apparatus according to claim 7, wherein cutoff frequencies of both of said first and second high-pass filters are substantially equal, and each of the respective cutoff frequencies has a predetermined value in a controllable frequency range of said pneumatic spring.

20 12. The apparatus according to claim 8, wherein cutoff frequencies of both of said low- and high-pass filters are substantially equal, and each of the respective cutoff frequencies is a predetermined value in a controllable frequency range of said pneumatic spring.

25 13. The apparatus according to claim 9, wherein cutoff frequencies of both of said first and second low-pass filters are substantially equal, and each of the respective

cutoff frequencies is a predetermined value in a controllable frequency range of said pneumatic spring.

14. An exposure apparatus comprising:

- a projection optical system for projecting a pattern
- 5 onto a substrate;
- a stage for holding the substrate; and
- an active anti-vibration apparatus with an anti-vibration table mounted under said stage, said active anti-vibration apparatus comprising
- 10 a movable portion mounted on said anti-vibration table,
- a pneumatic spring for supporting and driving said anti-vibration table,
- a servo valve for adjusting a pressure of said
- 15 pneumatic spring,
- an electromagnetic actuator for applying a force to said anti-vibration table,
- a displacement sensor for detecting displacement of said anti-vibration table,
- 20 an anti-vibration table displacement controller for generating a driving signal for said servo valve on the basis of an output from said displacement sensor so that said anti-vibration table keeps a predetermined posture at a predetermined position, and
- 25 an anti-vibration table vibration controller for generating a driving signal for said electromagnetic actuator,

wherein both said servo valve and said electromagnetic actuator are so controlled as to compensate for movement of a load that occurs when said movable portion moves on said anti-vibration table.

- 5 15. A device manufacturing method comprising the steps of:

applying a resist on a substrate;

drawing a pattern on the substrate with an exposure apparatus having an active anti-vibration apparatus, and

- 10 developing the substrate,

the active anti-vibration apparatus comprising an anti-vibration table,

a movable portion mounted on said anti-vibration table,

- 15 a pneumatic spring for supporting and driving said anti-vibration table,

a servo valve for adjusting a pressure of said pneumatic spring,

- 20 an electromagnetic actuator for applying a force to said anti-vibration table,

a displacement sensor for detecting displacement of said anti-vibration table,

- an anti-vibration table displacement controller for generating a driving signal for said servo valve on the basis of an output from said displacement sensor so that  
25 said anti-vibration table keeps a predetermined posture at a predetermined position, and

an anti-vibration table vibration controller for generating a driving signal for said electromagnetic actuator,

wherein both said servo valve and said  
5 electromagnetic actuator are so controlled as to compensate for movement of a load that occurs when said movable portion moves on said anti-vibration table.